

A MODIFICATION OF THE OPERATION FOR STRABISMUS.

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It is well known that, if the internal rectus muscle be divided in the manner now generally practised, it is possible to correct a squint of from 2 to $2\frac{1}{2}$ lines in adults, and from $2\frac{1}{2}$ to 3 lines in children. But, if the deviation exceed this extent, it will be necessary to perform two, three, or even more, successive operations.

Whilst the division of the effect between two operations, one on each eye, offers certain advantages with regard to the symmetry and uniformity of the movements of the eyes, the performance of a third or fourth operation—i.e., its repetition upon a muscle which has been already divided—is attended by great disadvantages. In fact, by such a repetition of the tenotomy, anything like an approximative calculation of the result is rendered impossible. In some cases the effect will be *nil*, in others excessive; so that, as was once said by a well known ophthalmic surgeon, when a third tenotomy has once been made, it is impossible to predict how many more it may be necessary to perform upon the same individual.

This is probably owing to the cicatricial adhesions which are formed after the first operation, as they prevent the performance of the usual simple tenotomy. For, if we be not careful to divide these adhesions completely, it may easily occur that a small band, which has escaped our notice, will mar the effect; or if, in order to ensure their complete division, we have been obliged to incise the parts freely, a divergent squint (in division of the internal rectus) not unfrequently results, with considerable loss of mobility inwards, sinking of the caruncle, etc.; in

short, all the disadvantages of the old and now abandoned operation.

About a year and a half ago, I felt anxious to remedy, if possible, these defects by an alteration in the mode of operating; and I then determined to investigate with greater accuracy: (1) the anatomical relations of the muscles, with regard to the capsule of Tenon, the sclerotic, conjunctiva, caruncle, etc.; and (2) the mechanical effect of the operation for strabismus.

The capsule of Tenon, which encloses the whole eyeball with the exception of the cornea, consists of two very different portions. The posterior half, with its smooth, firm inner surface, forms a cup in which the eyeball moves freely, as the head of a joint in the socket. This cup is pierced by the four recti muscles, and forms, at the point of perforation, a sharply defined ring, which enters into so close a connexion with the muscles, as to render any displacement between the two impossible. This close adhesion between the muscles and the posterior half of the capsule is, moreover, increased by sheath-like processes, which run backward from the outer surface of the capsule towards the orbit, and which are, for a certain distance, firmly connected with the muscles. But, towards the eyeball, no sheath-like processes extend from the posterior capsule; the latter terminates abruptly in the form of a ring, which encloses the spot where the muscles penetrate, and whence, for a very short distance, the muscles are quite free from any adhesion. But before the tendon is inserted into the sclerotic, it penetrates between the sclerotic and the anterior half of the capsule, and becomes united with the latter.

This anterior half of the capsule, which may be considered as standing towards the posterior portion in the relation of a semicircular lid to a semicircular cup, is much thinner than it, and is difficult to dissect, more especially on the dead body; for, like the conjunctiva, it rapidly diminishes in thickness and firmness after death.

If we trace the anterior half of the capsule from the anterior pole of the eye towards the periphery, we commence with a circular opening which corresponds to the size of the cornea, and through which the latter projects. The margin of this opening is

in close apposition to the sclerotic. Within a zone, which is bounded on one side by the opening on the margin of the cornea, and on the other by the line uniting the insertion of the four recti muscles, the conjunctiva, the capsule of Tenon, and the sclerotic, are firmly and immoveably connected together. At the periphery of the zone, this condition becomes, however, changed. The connection between the capsule and the sclerotic is interrupted by the passage of the muscles. The lax cellular tissue, which here connects the sclerotic with the capsule and the inner surface of the muscle, may perhaps have given rise to such complex and fanciful descriptions as those of Guérin. (*Gazette Médicale*, 1842, No. 6.) The idea that the muscles, after they have pierced the capsule, are accompanied as far as their insertion by sheath-like processes derived from it, has, owing to these descriptions, maintained itself in ophthalmology even up to this time, and has served as a basis for explanations of the effect of the tenotomy, the difference between the old and modern mode of operating, etc. This idea is, however, erroneous; for these sheath-like processes do not exist at all. But, as has been already mentioned, the anterior half of the capsule of Tenon certainly adheres to the upper surface of the muscle and is intimately connected with it. On the other hand, the conjunctiva is here also tolerably firmly connected with the capsule, as far as a somewhat irregularly circular line, which may be recognised by the fact that it lies at the bottom of a furrow when the eye is moved in an eccentric direction. The formation of this furrow prevents the sinking and tilting forwards of the conjunctiva, which would otherwise occur near the earuncle, as, for instance, when the eye looks far inwards. From this marginal line, the connexion between the capsule of Tenon and the conjunctiva becomes quite lax. One portion of the connective tissue, which composes the anterior half of the capsule, is reflected, and passes over into the submucous tissue of the eyelids; another portion attaches itself to the edge of the posterior half of the capsule, in order thus to close the latter. These two halves do not really pass perfectly over into one another, inasmuch as the edge of the posterior half of the capsule is partly continued into the band-like adhe-

sions between it and the edge of the orbit. From this description, we must call special attention to three points, as being particularly important with regard to the performance of the operation for strabismus.

1. The connection of the muscle with the capsule of Tenon is two-fold. On the one hand, there is the annular connection of the posterior capsule and its sheath-like processes (which are reflected towards the orbit) with the belly of the muscle; on the other, the firm adhesion of the anterior half of the capsule to the surface of the end of the muscle, which penetrates into the capsule.

2. The conjunctiva is firmly connected with the outer surface of the capsule of Tenon, from the edge of the cornea to an irregularly circular, sharply defined, marginal line; and, consequently, it stands in a very important relation to the muscles of the eye.

3. The caruncle, together with the semilunar flap, rest upon a band-like ligament, which passes from the capsule of Tenon towards the edge of the orbit. Now, when the internal rectus is contracted, and the eye rolled inwards, this band is rendered tense; and the caruncle, which is fixed to it, is consequently drawn in towards the inner edge of the orbit. But the outer edge of the caruncle, together with the semilunar fold and an adjoining portion of conjunctiva, are drawn backwards into a furrow. This is partly due to the fact that, during the movements of the eye, the conjunctiva lies, up to a certain point, in close apposition to the eyeball; and partly also to the fact that, on contraction, when the muscle, on account of its connection with the anterior half of the capsule, must draw the latter backwards, where it will be followed by the conjunctiva (which is likewise connected with the capsule), the semilunar fold, and the caruncle.

From a consideration of the first of these three points, we learn with regard to the mechanical effect of the operation for strabismus, that a division of the insertion of a muscle can only be brought about by a division of the portion of anterior capsule which covers the muscle. For this portion, which passes over the muscle to become attached to the sclerotic just before the insertion of the tendon, keeps the muscle in a fixed position with regard to the sele-

rotic; so that, if we attempt to sever the tendon from the sclerotic without dividing this portion of the capsule, the tendon would become reunited exactly at its original point of insertion; so that, in fact, it would not have receded at all. It would, however, be not only very difficult, but almost impossible, to avoid incising this portion of the capsule, as, on account of its intimate adherence to the insertion of the muscle, it is always divided simultaneously with it. Even in the subconjunctival operation, although the conjunctiva which covers this portion of the capsule is left intact, the capsule itself is divided along the whole breadth of the insertion of the muscle. This vertical incision in the capsule of Tenon, which always takes place simultaneously with the tenotomy, is the cause of the retrocession of the anterior part of the capsule covering the muscle, and of the annular portion of the capsule which keeps the muscle fixed, and consequently, also, the retrocession of the muscle itself. By increasing the length of the incision in the capsule (Graefe's division of the lateral processes), we may certainly produce a somewhat greater retrocession; but, owing to the second point mentioned above, it cannot be very extensive. For the connexion of the conjunctiva with the capsule does not permit a more considerable retrocession of the latter, unless we make an extensive vertical incision in the conjunctiva, analogous to that in the capsule, and thus jointly divide the conjunctiva, capsule, and tendon. Such a proceeding is, however, accompanied by considerable disadvantages. On account of the connexion between the muscle, capsule, and caruncle, the divided muscle draws the caruncle and the semilunar fold backwards and inwards, as well as that portion of the conjunctiva which was divided by the vertical incision. In consequence of this, these parts assume the same position when the eye looks straight forward, which they do in the normal eye when it is turned very far inwards. At the same time, the distance between the semilunar fold and the inner edge of the cornea is increased, as also the portion of sclerotic visible at the inner angle of the eye; and this gives to the eye that peculiarly disagreeable appearance which was so characteristic of the old operation.

In order to obviate these disadvantages, and yet obtain a much more considerable effect, I am in the habit of performing the following modification of the operation for strabismus, which is based upon the above considerations.

If the internal rectus is to be divided, I raise with a pair of forceps a fold of conjunctiva at the lower edge of the insertion of the muscle; and, incising this with scissors, enter the points of the latter at the opening between the conjunctiva and the capsule of Tenon; then carefully separate these two tissues from each other as far as the semilunar fold, also separating the latter, as well as the caruncle, from the parts lying behind. When the portion of the capsule which is of such importance in the tenotomy has been completely separated from the conjunctiva, I divide the insertion of the tendon from the sclerotic in the usual manner, and extend the vertical cut, which is made simultaneously with the tenotomy, upwards and downwards—the more so if a very considerable effect is desired. The wound in the conjunctiva is then closed with a suture.

The same mode of operating is pursued in dividing the external rectus; and the separation of the conjunctiva is to be continued as far as that portion of the external angle which is drawn sharply back when the eye is turned outwards.

The following are the advantages of my proceeding.

1. It affords the operator a greater scope in apporportioning and dividing the effect of the operation between the two eyes.

2. The sinking back of the caruncle is avoided, as well as every trace of a cicatrix, which not unfrequently occurs in the common tenotomy.

3. There is no need for more than two operations on the same individual, and therefore of more than one on the same eye.

With regard to point 1, we may, if we choose, produce either the effect of the common tenotomy, or we may correct a deviation of four lines or even more in adults, and of five lines or more in children. In order to prevent the repetition of misunderstandings which have arisen from my *vivâ voce* statements, I would remark, that it is by no means my intention,

when the squint is so considerable in degree (four lines in adults, five lines in children), to perform in all cases only *one* operation. Indeed, in such cases, I entirely agree with the principles laid down by Von Graefe ;viz., to divide the effect of the operation between the two eyes. It is only in exceptional cases, in which the mobility inwards of the squinting eye is much increased, and the aperture between the lids is not wider than in the other eye, that I correct so considerable a deviation by one operation. If certain personal considerations—as, for instance, the departure of the patient—render a repetition of the operation impossible, I prefer a single modified tenotomy to the proceeding adopted by other surgeons (*e. g.*, at Moorfields Hospital), viz., the simultaneous division of both internal recti muscles. If the deviation amounts to three lines in adults, or four lines in children, I generally perform only one tenotomy. It is probably chiefly owing to the possibility of curing a squint of this extent by a single operation, and without any sinking of the caruncle, that the prejudice against the operation for strabismus, which I encountered, not only amongst the public, but even in the medical profession, when I first settled in Paris, has now nearly entirely disappeared. So I am able, by this mode of operating, to correct the deviation in those cases in which the patient, owing to this prejudice, would never have consented to an operation upon both eyes.

With regard to point 2, I need only mention that the suture is to be applied in all cases. I think it of consequence that the conjunctival wound should be completely closed, and in such a manner that the conjunctiva reassumes its original position, so that the edges of the wound cannot become shifted from each other. If the finest English black silk and fine curved needles be used, no disadvantages can accrue, even if it should be necessary to apply several sutures.

But I consider the third point—the avoidance of more than two operations upon the same individual—as the most important. I hope that all surgeons who agree with me as to the disadvantages of a third or fourth tenotomy, will adopt my mode of operating in all cases of very considerable strabismus. The permanent effect must not, however, be estimated

according to the immediate, but the ultimate, result ; for the difference between these two is far greater in the modified operation (more especially if it be done extensively) than in the common one ; and this applies not only to the deviation, but also to the loss of mobility. We find more especially that the loss of mobility, which is very considerable immediately after the operation, subsequently diminishes more and more, until it finally does not in the least exceed that which follows the common operation.